In an experiment which is typical of many others, 194 seeds were placed in a moist chamber at 32° C. One seed had germinated in four hours, 50 seeds in eight hours, and the entire lot in 48 hours. The importance of this power of rapid germination can be appreciated when one realizes that, in its habitat, rain falls in showers (often torrential) of a few hours' duration. If the seeds are on the ground where they can absorb water, they could germinate quickly and get established before the ground became too dry for successful growth.

A sample of seeds which Dr. D. T. MacDougal planted in 1946 at Carmel, California, produced numerous plants which matured seed. The following spring he planted some of the 1946 crop of seeds in his garden and produced a second crop. Among these plants was one which attained a height of 3.34 m. (10 feet, 11 inches). The chromosomes in seedlings derived from this plant were 2n = 36. I owe the determination to Dr. J. A. Jenkins. The plant appears to be a tetraploid.

I wish to express my gratitude to Mr. Charles L. Babcock who prepared the Latin description of the species.

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TAXONOMY AND EVOLUTION OF VASEYANTHUS

Howard Scott Gentry

Vaseyanthus is a small genus in the Cucurbitaceae endemic to the arid and semiarid California Gulf Region of northwestern Mexico. It is generically characterized by the conic ovary of one to three cells, one or two of which commonly abort to leave a one-seeded fruit. The androecium and the few, erect to ascending, ovules place *Vaseyanthus* in the tribe Sicyoideae as outlined by Cogniaux (1916, p. 1). The closest relation is with *Echinopepon* Naudin (1865, p. 17), by reason of the several-celled ovary with erect to ascending ovules, rather than with *Brandegea* Cogn. (1890) and *Sicyos* L. (1753, p. 1013), both of which have single-celled ovaries with one pendulous reflexed ovule. The genera *Marah* Kell. (1854) and *Echinocystis* Torr. & Gray (1840, p. 542), although usually thought of as being associated with this group of genera, appear not to be closely related because of their highly flexuous anthers of reduced number, hypogeous germination. and large round seeds. Generically *Vaseyanthus* is separated from its nearest relative, *Echinopepon,* by the globose body of the fruits with thick, indurate, vescicular pericarps, the reduced number of cells and ovules, and a strong tendency towards reduction in the number of stamens. This genus, as represented by four entities, exhibits a relatively mild state of specific development.

Weak speciation suggests a young genus, but this is not borne out by later considerations.

The genus was initiated by Alfred Cogniaux (1891), who based it on *Vaseyanthus Rosei,* a smooth-fruited oddity. Only the year before he had described *Echinocystis Brandegei,* defining by its characters a new section, *Pseudo-Echinopepon* (1890). Although the latter has an echinate fruit, it is certainly congeneric with *Vaseyanthus Rosei* and it is surprising that such a keen student of the Cucurbitaceae did not recognize the relationship. Doubtless, he was misled into forming a generic category by the unusual non-echinate fruits of the latter.

J. N. Rose (1897, pp. 119–120) made the next taxonomic moves by bringing *Echinocystis Brandegei* and *Echinopepon insularis* of Watson (1889, p. 51) into the genus. He failed, however, to recognize the congeneric position of *Echinopepon Palmeri* Wats. (l. c., p. 52) and relegated it to *Brandegea,* where it certainly does not belong.

I. M. Johnston (1924, pp. 1180–1182), with his series of collections, was the first to recognize the close relationships of the described species. He interpreted the lot as a monotypic genus with two varieties, *Brandegei* and *inermis,* under *Vaseyanthus insularis.* Unfortunately, however, he failed to identify his smooth-fruited variety, *inermis,* as Cogniaux's primary species, *V. Rosei.* Johnston placed *V. Rosei* in synonymy under *V. insularis Brandegei* (Cogn.) Jtn. Cogniaux, however, described the fruit as "laevis", and a photograph of the type in the Gray Herbarium (La Paz. *Palmer 102* in 1890) shows the typical non-echinate fruit. Since the first epithet for a given category must retain priority, Johnston's name stands and the type species is now properly a synonym under *V. insularis inermis* Jtn.

The selection of the echinate-fruited *Vaseyanthus insularis* as the varietal carrying name makes an unusual form of this complex stand as the type specimen. An isotype of *Vaseyanthus insularis* (*Palmer 409* in 1887 from San Pedro Martir Island) is an unusually coarse-stemmed and broad-leaved form with shallow leaf-lobing, apparently grown under unusually moist conditions or in the shade. Priority, however, again dictates its retention as an inclusive name for the complex.

The fruits of the genus are small, ranging from 8 to 15 mm. in diameter exclusive of the prickles, which are from 1 to 7 mm. long. The body of the fruit (fig. 1) is globose, or ellipsoidal (in case the upper ovule develops), or somewhat oblique (in case only one of the lateral basal ovules develops). The body of the fruit is capped with a prominent, smooth, tapering beak, persistent in some varieties, but tardily deciduous in others. The ovule is attached to the bottom of the cell by a short funicle at the base and is erect or nearly so. The smaller size of the upper ovule in *Vaseyanthus insularis* (Wats.) Jtn. (fig. 2) is indicative of

its strong abortive tendency. The stamens are united to form an androecium, but the anthers are distinct, varying in number from 3 to 5, and are deeply crescentic or horseshoe-shaped, the whole making a short compact column with the common connective hidden in the center.

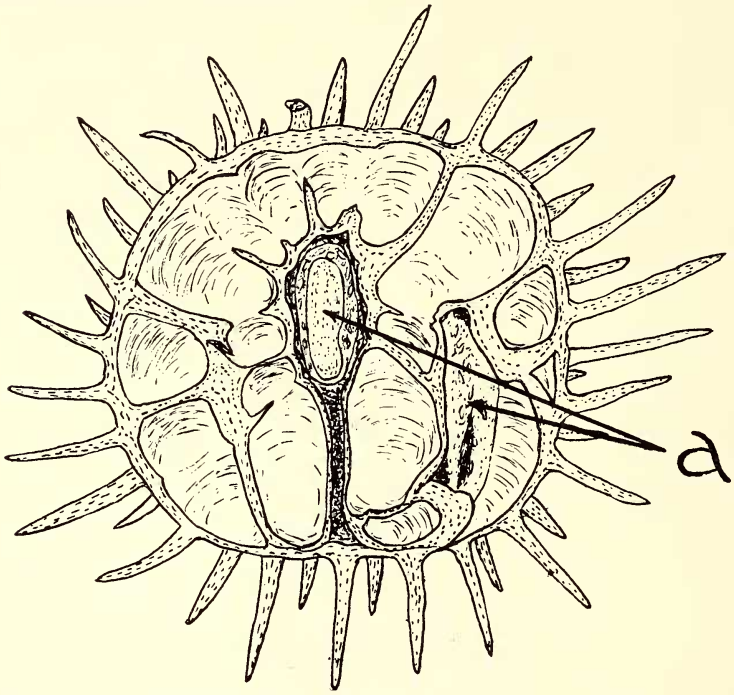

Fig. 1. Mature fruit of *Vaseyanthus Brandegei* (cross section): *a*, seeds in separate cells surrounded by empty vescicles. ×6.

In the following disposition of the variants, I have taken considerable pains to perceive reliable criteria for phenotypic segregation. I do not follow the tenet that morphologic intergradation *ipso facto* reduces closely related species to subspecific status or synonymy. I have attempted to segregate the variants according to phenotypic populations as expressed in two or more discernible and consistent morphological features. Where these features are strong, I have recognized species; where weaker, varieties. In making the segregations, I have also been influenced by the geographic, and more particularly by the physiographic, distributions of the *Vaseyanthus* populations. As will be demonstrated, the distributions corroborate the taxonomic segregates and have given assurance for the taxonomic definitions.

The most expressive features for taxonomic segregation of the populations are found in the characters of the following

organs:—(1) The fruits—whether they are echinate or smooth, the length, and, to a lesser degree, the density of their prickles; whether tardily dehiscent or not dehiscent; their sizes and shapes.

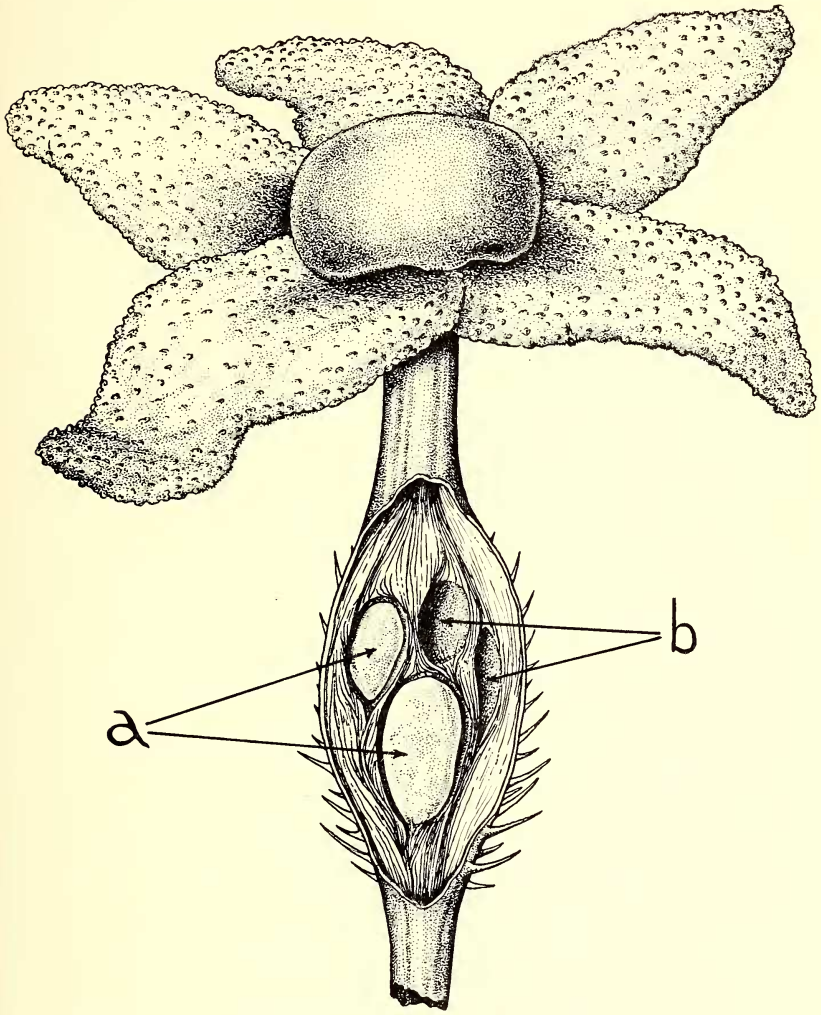

Fig. 2. Gynoecium of *Vaseyanthus insularis: a,* young ovules; *b,* developing vescicles. ×28. (Drawn from isotype.)

(2) The position and number of the seeds, whether proximal or distal. In the latter case, the development of the upper ovule appears to effect an irregular transverse rupture, with the fruit at length separating into two partly open disseminules. (3) Whether the beak or rostrum is persistent or at length deciduous;

its shape. It never appears to separate as a calyptra, for, in cases where it is shed, it does not leave a dehiscently opened fruit, but is choked off by the hardening walls of the basal body of the fruit. (4) The number of stamens, whether constant or variable within a population, appears to have taxonomic value in some cases. (5) The leaves, though highly variable within a population, may within limits, substantiate evidence for segregates as primarily expressed by fruits and stamens. The entities overlap in degree of leaf-dissection, in the character and density of trichomes, in expansion, and in thickness. Much of the variation may be determined by seasonal environmental differences. A moist fertile soil produces a wide, soft, shallowly-lobed leaf of sparse pubescence, while a moisture-impoverished season or situation appears to produce a small blade with dense scabrous trichomes. In spite of these variable factors, however, a certain coordination of leaf characters appears perceptible within the intervariant limits of the phenotypes.

The cupulate or shallowly campanulate corollas with their spreading lobes are rather uniform throughout the genus. They are minute, delicate, and do not lend themselves readily to study in dried specimens. The lobes are broadly linear to triangular, commonly knobby-glandular, the glands colorless or tinged with pink, the latter apparently a physiologic stage not correlative with populations.

With the above characters it would appear feasible to make an adequate taxonomic account of the genus. The 28 available collections seem, however, quite insufficient for a complete treatment. Until more collections are gathered and genetic studies made, perhaps the following segregation of the variants will suffice to prepare the genus for inclusion in Wiggins' forthcoming flora of the Sonoran Desert. It is based on herbarium material loaned by the Herbarium of the University of California in Berkeley and by the Dudley Herbarium of Stanford University, to the curators of which the author expresses his thanks for their cooperation. In addition, the specimens in the herbarium of the Allan Hancock Foundation at the University of Southern California have been studied.

Vaseyanthus Cogn. Zoe 1: 368. 1891.

Small, slender, herbaceous perennial (or annual?) vines with palmately lobed or dissected leaves and small globose or ellipsoid, smooth or echinate fruits. Stems sulcate, commonly pustulate on the angles, pubescent or glabrous, the internodes relatively short; tendrils petiolate, usually bifid; leaves petiolate, commonly hispid-pubescent and variably scabrous with conic trichomes; flowers small, 5-merous, monoecious; calyx-tube generally cupulate or campanulate, the lobes minute; corolla cupulate with spreading lobes; staminate flowers racemose, simple or compound, long-

pedunculate; anthers 3–5, linear, horseshoe-shaped on a column of united filaments; pollen large, smooth, depressed-globose, obscurely 5–6-sulcate; pistillate flowers small, pedunculate, solitary in same axils as the male flowers; calyx and corolla adnate; ovary conic to ovoid, 2–3-celled, long-rostrate; style short, stigma thickened, discoid; ovules one in each cell, erect to ascending, or rarely even horizontal, attached near base of cell, the upper ovule commonly aborting; fruit narrowly ovoid to globose, thickly long-rostrate, the rostrum persistent or deciduous, the body dry, indurate, vescicular, indehiscent or rarely dehiscent, armed or smooth, 1–3-seeded; seeds erect or ascending, obovate or ovoid, somewhat compressed. Type species: *Vaseyanthus Rosei* Cogn.

It is not known if the genus is wholly perennial or partly annual. There are no roots or root-crowns present in the specimens studied. One collector of *Vaseyanthus insularis* has noted, "Vine from a perennial tap-root" (*Annetta Carter et al. 2001*). Cogniaux described *V. Brandegei* as having fibrous roots.

Key to the Species and Varieties

Mature fruits 1 cm. or more in diameter; prickles 4–7 mm. long; stamens 5; leaf lobes rounded to acute, often mucronate (Cape District)	1. *V. Brandegei*
Mature fruits less than 1 cm. in diameter; prickles 2–3 mm. long or lacking; stamens 3–5; leaf lobes not rounded, mucronate to aristate	2. *V. insularis*
Fruit echinate	
Leaves thickish, densely pubescent or scabrous, the lobes mostly triangular, acute, mucronate (peninsular and insular)	2a. *V. insularis var. originalis*
Leaves thin, sparsely pubescent to glabrate, the lobes mostly lanceolate, acuminate, aristate (mainland and San Pedro Nolasco Island	2b. *V. insularis var. Palmeri*
Fruit not echinate (peninsular and insular)	2c. *V. insularis var. inermis*

1. Vaseyanthus Brandegei (Cogn.) Rose, Contr. U. S. Nat. Herb. 5: 119. 1897. *Echinocystis Brandegei* Cogn. Proc. Calif. Acad. Ser. 2, 3: 59. 1890. *Vaseyanthus insularis Brandegei* (Cogn.) Jtn. Proc. Cal. Acad. Ser. 4, 12: 1182. 1924.

Relatively coarse herbaceous vines with deeply lobate leaves and strongly echinate, globose, indurate fruits; stems coarse, strongly ribbed, hispid, glabrate; tendrils bifid, stoutly long-pedunculate, sparsely hispid near the base; leaves rather thick, orbicular in outline, 2–5 cm. broad, rather densely and strongly hispid below and above, and somewhat muriculate above, 5–7-lobed, with open rounded sinuses, the lobes lanceolate or ovate, or spatulate, mostly rounded, but sometimes acute, often mucronate; petioles from somewhat shorter than to longer than the leaf-lobes, curved-hispid; male flowers in compound racemes, the peduncles mostly shorter than the leaves; flowers numerous;

pedicels glabrous, persistent; corollas white, 5–6 mm. broad; stamens 5; ovary densely echinate, ovoid, with a slender beak; fruit globose, with thick vesicular walls, strongly echinate, pericarp and prickles at base sparsely pilose; body of fruit 12–20 mm. in diam., 2-celled, 1–2-seeded, 1 seed often aborting; prickles mostly 5–7 mm. long; seed compressed, dark brown, obliquely and broadly oval, narrowed at base.

Type locality: "ad Todos Santos" in the Cape District of Baja California, Mexico.

I have not seen the type, its whereabouts being unknown to me. Other specimens examined are: Guadalupe (southern Magdalena Plain), Jan. 17, 1890, *Brandegee s. n.;* San Jose del Cabo, Jan.–March 1901, *Purpus 490;* Espíritu Santo Island, April 1892, *Bryant 230;* San Diego Island, May 27, 1921, *Johnston 3929,* "trailing over cobble stones on beach"; 4 miles south of Guadalupe, March 21, 1935, *Whitehead 840,* "Along beach on sand dunes"; 15 miles south of Rancho Venancio (southern Magdalena Plain), March 21, 1935, *Shreve 7195;* Los Muertos, Cape District, March 5, 1937, *Rempel 78.*

These collections indicate a littoral species, but they do not constitute positive evidence for excluding it from the interior. In this series there is little apparent gradation in the size of the fruits, length of prickles, and number of stamens towards the *V. insularis* complex. The character of the leaf, though not so easily described, shows a definite homogeneity apart from the smaller and more acutely lobed leaf of *V. insularis.* In the lack of intergrades, therefore, the population of *V. Brandegei* appears to have a firm basis for specific segregation.

The existence of *V. Brandegei* on the southern end of the Magdalena Plain I attribute to post-Tertiary migration, subsequent to the joining of the Cape Island and the peninsula in Quaternary times. Hence, *V. Brandegei,* a postinsular endemic, is now migratory.

2. Vaseyanthus insularis (Wats.) Rose, Contr. U. S. Nat. Herb. 5: 120. 1897. *Echinopepon insularis* Wats. Proc. Am. Acad. 24: 51. 1889.

Originally described as annual but probably perennial; stems slender, striate, pustulate on the angles, scabrous-pubescent, curly-pubescent, or puberulent to glabrous; leaves cordate in outline, 2–7 cm. long, 2.5–8 cm. wide, sparsely or densely hispid above and below, in age or adversity becoming scabrous with conical processes, shallowly or deeply 5–9-lobed, the lobes triangular to lanceolate, denticulate, acute to acuminate, mucronate to aristate, the basal sinus broad and open; petioles equaling or much exceeding the blades; male inflorescence racemose with short lateral branches, shorter than or much exceeding the leaves; calyx shallowly campanulate, the teeth green, minute;

corolla 5-cleft, 4–5 mm. broad; stamens 3, 4, or 5, deeply bent; female flowers short-pedunculate, somewhat larger than the male; fruits conic to ellipsoid, the long beak mostly smooth, tardily deciduous or persistent, the body of the fruit globose to ellipsoid, 7–9 mm. in diam., indurate (but slightly so in 1 variety), spongy or vesicular, smooth or covered with straight stiff prickles 1–3 mm. long, 1–2-celled, 1–2-seeded; seed erect, smooth, oblong-obovate in outline, subcompressed, with a broad flat base, 4–5 mm. long.

2a. V. INSULARIS var. **originalis** nom. nov.

Leaves thick, relatively densely pubescent, commonly divided half way to the base or less, the lobes triangular to lanceolate, denticulate to irregularly sub-lobed; body of the fruit globose or oblong, short-echinate; beak apparently finally deciduous, broad at the base, its ovule usually aborting.

Type. San Pedro Mártir Island, *Edward Palmer 409* in 1887.

Specimens examined include an isotype and the following: La Paz, Oct. 1, 1890, *Brandegee 230;* North San Lorenzo Island (Las Animas), June 23, 1921, *Johnston 4195,* "Common, trailing over cobblestones on beach"; Small bay north of Puerto Escondido, ca. 23 km. south of Loreto, Nov. 20, 1947, *Carter et al. 2001,* "Vine from perennial tap root; flowers white; trailing over rocky beach well above high tide line"; San Francisquito Bay, March 30, 1947, *Harbison 41638.* This last is atypical in having nearly glabrous stems and fruits, which condition suggests *V. insularis* var. *Palmeri,* but the small angulate-lobed leaves, the lobes with obtuse tips, is quite unlike that variety.

2b. V. INSULARIS var. **Palmeri** (Wats.) comb. nov. *Echinopepon Palmeri* Wats. Proc. Am. Acad. 24: 52. 1889. *Brandegea Palmeri* (Wats.) Rose, Contr. U. S. Nat. Herb. 5: 120. 1897.

Stems sparsely puberulent to glabrous; petioles slender; leaves thin, sparsely to somewhat densely pubescent, rarely scabrous, commonly divided to below the middle of the blade, the lobes lanceolate, commonly saliently toothed, acute to acuminate, aristate; body of fruit globose, the pericarp sparsely puberulent; prickles 2–3 mm. long, glabrous or glabrate; beak narrow, acute, persistent.

Type. Guaymas, Sonora, *Palmer 304* in 1887.

Besides an isotype studied, the following collections have been examined: collector?, sheet in Herb. of T. S. Brandegee, U.C. Herb., Guaymas, 1893; Guaymas, Sonora, Dec. 17, 1939, *Drouet & Richards 4034,* "trailing over rocks at base of cliffs on mountain"; January 26, 1927, *Marcus E. Jones 22982;* Bahía San Carlos, February 8, 1940, *Dawson 1073;* San Pedro Nolasco Island, April 17, 1921, *Johnston 3132,* "In a gulch near sea, covering rocks and shrubs with a very dense thick mat of stems growing interlaced with no. 3131, a smooth-fruited plant."

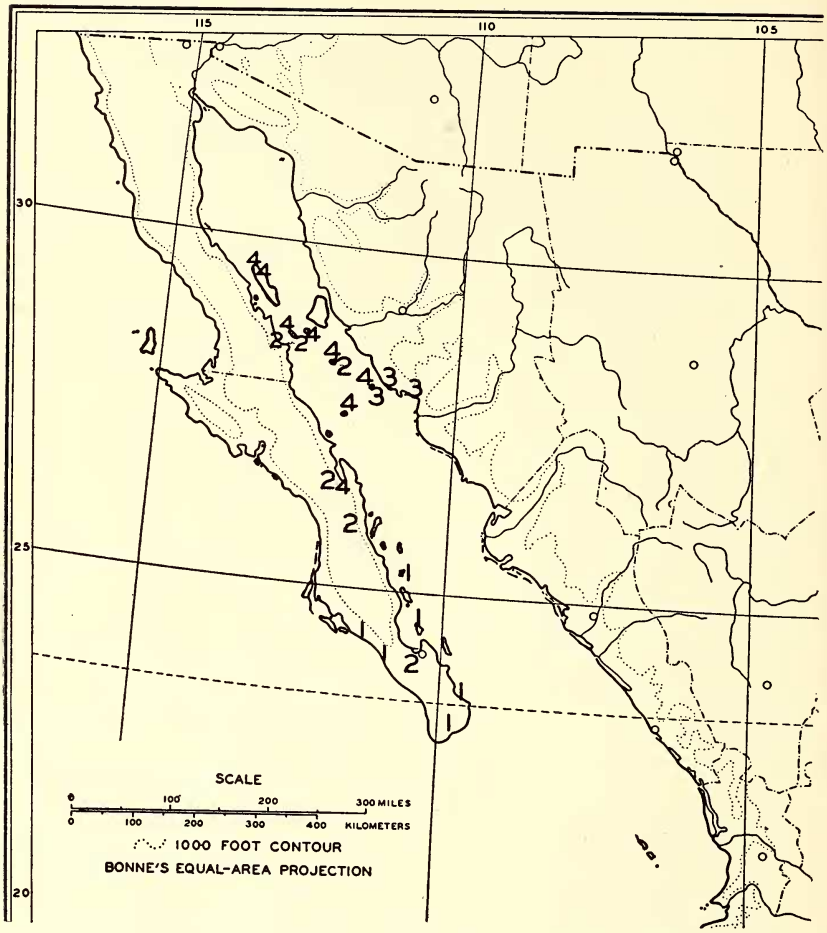

Fig. 3. Distribution of *Vaseyanthus* in the California Gulf Region: 1, *V. Brandegei;* 2, *V. insularis originalis;* 3, *V. insularis Palmeri;* 4, *V. insularis inermis.*

Although not so easily defined, this segregate may be more strongly divergent from *V. insularis* var. *originalis* than is the following smooth-fruited variety.

2c. V. INSULARIS var. INERMIS Jtn. Proc. Cal. Acad., ser. 4, 12: 1182. 1924. *Vaseyanthus Rosei* Cogn. Zoe 1: 368. 1891.

Stems and leaves scabrous-pubescent; leaves small, the dried blades mostly less than 3 cm. broad, broader than long, rarely divided half way to base, commonly shallowly 7–9-lobate, the lobes broad, angulate, obtuse to acute, mucronate to aristate; body of fruit unarmed, either obliquely globose with a persistent

attenuate beak and 1-seeded, or obliquely ellipsoid, and 2-seeded, tardily and irregularly dehiscent around the middle.

Type. Isla Partida (north or south one?), Gulf of California, *Johnston 3224,* April 22, 1921.

An isotype examined notes the variety as "Common on slopes facing sea, especially in steep draws; trailing over shrubs and rocks". It has unusually large leaves, up to 5 cm. broad, with shallow triangular lobes. Another collection by Johnston, without number from the same island, has deeply cut leaves with linear-lanceolate, acuminate lobes. The remaining sheets are rather uniform in their small leaves with shallow triangular lobes: Mejia Island, April 30, 1921, *Johnston 3355,* "trailing over low bushes in an open wash"; Puerto Refugio, Angel de la Guarda Island, January 26, 1940, *Dawson 1024;* Tortuga Island, May 11, 1921, *Johnston 3606,* "Forming dense masses on shrubs, mainly on north and east parts of island. These growths conspicuous from gulf;" San Pedro Nolasco Island, April 17, 1921, *Johnston 3131,* "Growing in dense masses over shrubs and rocks in a gulch near sea"; Tortuga Island, March 17, 1937, *Rempel 221;* Baja California, *Purpus s. n.;* south end of Bahía Concepción, Dec. 1, 1946, *Wiggins 11508* (in part).

The maintenance of this variety rests solely on the non-echinate character of the fruits. Johnston, who studied the plant in the field, has stated (l. c. p. 1181) that plants with smooth fruits in some localities may grow intertwined with those of echinate fruits (e.g. *Wiggins 11508*) and without intergrades, or in other localities he noted vines with fruits furnished with many prickles as well as vines with fruits having very few. I have been unable to perceive other correlative characters to strengthen the variety. The difference may be based on a segregating Mendelian factor and the variety may be really only a form, but without genetic evidence, I defer the obvious taxonomic move. Its distribution appears to be coextensive with *V. insularis* var. *originalis.*

Evolution

The area occupied by *Vaseyanthus* lies in the heart of the unique California Gulf Region. This area, physiographically, has been highly modified during the Tertiary Period, and the relative occupancies of land and sea today bear but little resemblance to what they were in early Tertiary. According to geologic studies (see Schuchert's synthesis, 1935), a sea invasion of the trough got under way in the Oligocene. Previous to that and subsequent to the Cretaceous seas, the present gulf was apparently terra firma. In early Miocene times, the gulf reached to about the latitude of Angel de la Guarda and Tiburón islands. By late Miocene, the gulf appears to have reached its greatest extent, occupying the Colorado Desert and adjacent western Sonora and Arizona. As the peninsula and mainland became

more distantly separated, the salt water barrier surrounded the mid-gulf islands, most of which appear to date from the late Miocene, while the islands near the Cape District and the Cape District itself appear to be older. During late Pliocene and Pleistocene, the modern peninsula arose. Also the shore lines of both coasts advanced with the growth of piedmont attritions, constricting the gulf and leaving it outlined as of today.

It is logical to infer that the growth of the gulf caused extensive disjunctions in plant populations. In species of general distribution, for example, there would have resulted rather numerous isolated populations on the respective islands, on the peninsula, and on the mainland. In a recent paper (1949), I have pointed out the importance of land and sea ratios to the development of the flora in the California Gulf Region. Since isolation has long been a recognized factor in speciation, we may well examine the distribution of *Vaseyanthus* in the light of the physiographic factor. But first let us discuss the dispersal facilities of the genus, since it is possible that the distribution of *Vaseyanthus* is due mainly to its dispersal efficiency and the present occupancies are a modern pattern.

The fruits of *Vaseyanthus* appear well equipped for dissemination by water, wind, or animal transport. They are tough, light in weight, and provided with prickles. Their roundness also conceivably makes them susceptible to rolling by strong winds. The seed is safely (?) protected in a strong vehicle. Altogether, the fruit appears admirably designed to spread the genus widely, but this obviously has not happened. The dispersal facilities appear to have been limited by environmental factors or possibly, by the plant's own physiologic ineptitude, since the related genus, *Echinopepon,* with fruits less proficiently adapted for dispersal, nevertheless at present exploits a wider horizon. The members of *Vaseyanthus* are in large part surrounded by salt water. But, if salt water be a serious barrier, plants on the Cape District have a long northward land path open to them, while those on the mainland theoretically could have extended north or south. Both the occasional seasonal hurricanes and the extinct mammal populations could have served to effect at least sporadic dissemination of seeds in the geologic long past. The areal occupation of the genus does not appear to have been limited by lack of a dispersal mechanism. Although fit for local perpetuation, the fruit characters do not explain the restricted distribution.

Since the genus is now within an area receiving summer rainfall, it is probable that existence is dependent upon some of the conditions inherent in that type of environment. It is apparently barred from more northward occupancy by the conditions attendant on lower winter temperatures and summer droughts. The physiology appears to have been and still to be inadequate

for the occupancy of more than the narrow environmental range encompassed by the shores of the central and southern part of the Gulf of California. However, the physiologic factors cannot show, except through experimental methods, the causes for the confined and disjunct present distributions of the members of the genus. For the purposes of this discussion, therefore, the physiologic potentialities can contribute little, although their possible significance should be kept in mind.

When considering the problem deliberately from the environmental angle, there are developmental factors of special significance. Historically, the environment can be revealingly defined by the physiography. In the area under consideration an eventful, sequential, datable land evolution occurred. It offers strong evidence for interpreting *Vaseyanthus* distributions.

The distribution of *Vaseyanthus* appears to be that of a Tertiary relic. It is closely peripheral to the borders of the early Miocene gulf, when northern limits of that body of water reached only to about the middle of the present gulf. Discounting the more remote possibility of dispersion via sea water, the spotted occurrences on islands, peninsula, and mainland appear to represent remnants of a general distribution in the early or middle Tertiary anterior to the gulf invasion. This is particularly true of the *Vaseyanthus insularis* complex, since *V. Brandegei* occupies the older insular area represented by the Cape District, as will be discussed later.

Reasoning from this basis, the distinct populations of *Vaseyanthus insularis* more or less started their divergent tendencies in the Miocene period. If so, the rate of speciation has been surprisingly slow. Not a single clear-cut species appears to have evolved in the 15 to 20 million years estimated to have elapsed (year estimate based on that as in Schuchert & Dunbar, 1947, pp. 64–71). Evolution of the disjuncts has at present reached the varietal or subspecies stage. Judging from the unstable tendencies of the stamens and ovarian cells, one would suppose it to be a complex in genetic flux, for which only the random segregation in a varying environment was needed for the genesis of new species (cf. Turesson, 1922). However, in this connection, it is also well to remember that morphological instability in floral parts is common in genera known to be very old, e.g., *Nymphaea, Distylium, Magnolia,* etc., so that floral lapses in *Vaseyanthus* may be indicative of an old genus. In the disjunctive situation of *Vaseyanthus,* there was obviously lacking the necessary genetic coherency for any variant to diverge apprecibly along independent lines. Genetic studies might determine the mechanics of this failure. So far as we know the complex today, the net result has been the development of a variety on the mainland, and two varieties coinhabiting the islands and the peninsular gulf shore.

Physiographically, the case of *Vaseyanthus Brandegei* is just as clear. Except for recent minor extensions, it is confined to the Cape District of the peninsula and adjacent gulf islands, which are part of the same basic granitic monolith. Until most recently, the cape was a well isolated island, apparently dating from the early Tertiary (Gentry, 1949, pp. 81–98). The separate specific status of *Vaseyanthus Brandegei* is therefore neatly correlated with its long isolation from other members of the genus. Morphologically and genetically, it appears to be a stable species. Under a relatively constant insular and oceanic type of climate, it has long been environmentally secure. Just as *V. insularis* appears to express, through morphological vagaries, the dynamics of changing land forms, so *V. Brandegei* indicates an insular constancy through its morphological unity.

Thus we have two lines of evidence for the evolution of *Vaseyanthus:* from morphology and physiography. Morphologically, its species have had a common ancestor with those of *Echinopepon. Vaseyanthus* has diverged more in developing the hardened, vesicular 1-seeded fruits and in the tendency to drop stamens, while *Echinopepon* has evolved further by the development of more species and by the greater variation of its perianth and trichomes. *Vaseyanthus insularis* is more modified than *V. Brandegei* in its smooth-fruited variety and the tendency to drop stamens.

Geologically, the evidence indicates that the evolution of land forms had a great deal to do with specific divergence in *Vaseyanthus.* It is surmised that early in the Tertiary, a common ancestor of the *Vaseyanthus* species occupied the California Gulf Region. The invading Tertiary gulf isolated segments of the population: first that of *V. Brandegei* on the Cape District island in early Tertiary times; second, the population of *V. insularis,* was cut into many small populations on either side of the gulf and on the islands within the gulf, in mid-Tertiary. These segregations may have been interrupted by subsequent land resurgence with attendant remixing of plant populations, but in the long run, the segregations allowed opportunity for expression of genetic differences. The differences, as of today, are perceptible in taxonomic varieties. Because segregation of *V. Brandegei* and *V. insularis* dates from the early Tertiary to Recent, it appears to have required most of the Tertiary to develop specific status, and because the *V. insularis* population became disjunct in the Miocene, it appears to have required about one third of the Tertiary to engender varieties in this genus.

Tentatively, the taxonomy is supported by the physiography and vice versa. However, I do not wish to leave the reader with the impression that either line of evidence is erected to support the other, but both together form a hypothesis fit to be tested with studies of other genera. Concommitantly, more exhaustive geologic field studies are badly needed. The hypothesis is that

evolution of life forms is correlative with the evolution of land forms in the California Gulf Region and that plant speciation in some cases can be synchronized somewhat with geologic time.

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ON THE SUBSPECIES OF LEPIDIUM MONTANUM

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In the fall of 1945, Mr. R. C. Barneby sent me a series of specimens of a shrubby *Lepidium* which he and Mr. Ripley had collected twelve miles south of Mountain Home, Elmore County, Idaho. I ventured the opinion that the collection comprised another variant of the plastic *L. montanum* Nutt. ex T. & G. and with this opinion Mr. Barneby agreed. However, in the fall of 1947, he sent me a second series of plants collected near Duchesne, Duchesne County, Utah, which were more similar to the specimens from Idaho than to any other of the various subspecific entities of *L. montanum*. After studying the two collections I believe them to be sufficiently distinctive to warrant description.

Accordingly, these two shrubby-based, dwarf plants were described as new subspecific entities of *L. montanum* and a key was